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MECHANICAL EXACTNESS.

The practice of roughing out and then dressing by grinding, scraping, and paring to exactness must give way to that of accurate measurements and accurate tools to work to those measurements. It is evidently of little value to produce by expensive processes accurate gauges for screws, interiors, exteriors (for diameters), and scales for linear measurements, if there are not sufficiently accurate tools to work up to these gauges. Hand skill, unaided by mechanical exactness in machine tools, is not always sufficient to begin a job *ab novo* with exactness, or to carry it to completion without variation from the standard. In many instances an error multiplies itself and makes an insignificant divergence a serious fault. This may be particularly the case when the leading screw of a screw cutting lathe is faulty, and a longer screw than that of the lathe is to be cut by sections. If there is an error in the working portion of the leading screw it will reproduce itself, sometimes with aggravated quantity, until the end of the produced screw is reached, ruining the screw for exact work.

There has been recently started, in Hartford, Conn., a new company formed for the purpose of producing exact leading screws for lathes, racks, and pinions for longitudinal and lateral movements, and the closest gauged rules, or bars, for measurements to be applied to fine mechanical work, with or without the aid of the microscope.

These results are obtained by simple mechanical contrivances, which are patented. So close is the guided action of the device that a leading screw of a screw-cutting lathe 36 inches long was detected as lacking in one-twentieth of an inch in the three feet of thread, and quite important variations were noticed in that length. In fact, the leading screw of a screw cutting lathe made by one of the well known manufacturers of machine tools was so faulty in a distance of six feet that differently threaded screws could be cut by it at different portions of its length. More than this, it was discovered that a variation of one fifteen-thousandth of an inch was discovered—and rectified—which extended through only four inches in length of the screw. The result of the tests proved that in six feet of a leading serew there were three grades, only one of which was the pitch desired.

These variations in the leading screws of lathes are not uncommon, in fact there are many worse ones. No amount of judicious grinding will rectify an initial wrong in the cutting of the thread; it may reduce its irregularities, but it is impossible to move a thread bodily on its core, and whatever is ground off on one side leaves so much opportunity of backlash on the other.

It is evident that any device that can produce absolutely true threads running over inches and feet is an advance in the direction of exactness in machines and consequently in the perfection of their productions.

Remarkable Colors in the Sky.

Shortly after sunset, on November 27, 28, and 29, the western sky presented a most peculiar and striking appearance, the red light being intensely bright, almost dazzling, and reaching nearly to the zenith. The phenomenon was visible over a large part of the Northeastern States.

One supposition is that the color resulted from vaporous strata in the higher regions of the atmosphere. Another is that it was due to reflections from meteoric dust. The New York *Sun* gives the following:

A remarkable observation was made by Prof. Brooks, an industrious astronomer of western New York, on the evening of Nov. 28. While searching with his telescope for comets, he saw what he describes as a shower of telescopic meteors "near the sun." This, of course, means that they were near the apparent place of the sun in the sky, and not literally near to that body, for the sun had already set at the time, and if what Prof. Brooks saw was really a meteor swarm, the meteors must have been in the upper regions of our atmosphere. Supposed flights of meteors seen through telescopes have occasionally turned out to be flocks of birds, but an observer as careful and experienced as Prof. Brooks seems to be would not be likely to make such a mistake as that.

Assuming, then, that he really did see an extraordinary swarm of meteors, and remembering that meteors large enough to be visible without telescopes, and some of great size and brilliancy, have recently been unusually numerous, the suggestion that the red light seen in the sky for several evenings past long after sunset may be caused by reflection from clouds of meteoric dust in the upper portion of the atmosphere is not unnatural. There are several reasons for thinking that the strange light is the result of some such cause as the presence of meteoric dust rather than of differences of density in the atmosphere leading to extraordinary refraction.

In the first place, the phenomenon has not only been visible over an immense extent of territory, but it has lasted several days, and has been seen in the east before sunrise as well as in the west after sunset, so that any abnormal refraction in the atmosphere would have to be of almost incredible persistence in order to account for the observed appearances. Besides, during this time there have been considerable atmospheric changes, especially in respect to temperature. These remarkable sunset displays have also been accompanied by a notably hazy appearance of the sky.

It is well known that the earth is daily and nightly pelted with millions of meteors, the vast majority of which are almost instantly consumed by the intense heat developed as they dash into our atmosphere. The products of the combustion of these meteors filter slowly down through the air, and have been found in the shape of metallic dust on the snow fields in the Arctic regions, on mountain peaks in Europe, and in other similar localities, being recognizable by their peculiar chemical composition. It is also known that the solar system abounds with swarms of meteors revolving around the sun, and that the earth crosses the paths of a number of these, occasionally encountering the swarms themselves.

The vast majority of these meteors are very small, those that are seen weighing on an average probably only a few grains; and since the telescope reveals millions which escape the naked eye, it is reasonable to conclude that millions more are too small to be seen even with telescopes—mere meteoric dust. There are historic instances of supposed falls of meteoric dust, the most remarkable, perhaps, being that of 1783, when Europe, part of Asia, and part of North America were covered for months with a dry fog or haze, which excited the greatest alarm. Prof. Brooks' suggestion that the earth has encountered a cloud of meteoric dust is not, therefore, without foundation in probability.

If the recent blazing sunsets have really resulted from such a cause, they are likely to continue, in a modified form, for some time, gradually disappearing as the dust sinks lower in the atmosphere. But, although so many reasons can be advanced which give probability to the theory that meteoric dust is concerned in the production of these strange sunset effects, yet it cannot be considered as proved, and some better explanation may be offered. Whatever the true explanation may turn out to be, however, everybody seems to agree in the opinion that the red glare in the west during the last three or four evenings has been one of the most singular spectacles beheld in the sky for many years.

Electric Railway.

A trial of the Daft Electro Motor for propelling railway cars took place at Saratoga, N. Y., on 24th November last.

In the Siemens Berlin electric roads, the current to operate through the motor is sent through wires overhead, it having been found inconvenient to so insulate the track as to use the rails therefor, and also that, unless properly covered and insulated, the rails would be highly dangerous to other travel. Mr. Daft, by a subdivision of his dynamo, claims to obtain a current of such low tension that all danger from contact is avoided, but the insulation was by no means thoroughly effected by his sending the current through a third rail in the center, of which the fastening spikes were removed from the rail by a strip of vulcanized rubber. Then, although one could touch the rails without feeling any unpleasant shock, it was very evident that many were temporarily "excited" in crossing the tracks on the occasion referred to, while no less than four horses fell on the track from the effect of the current, and had to be helped off.

The actual performance consisted in the hauling by a two-ton motor of a five-ton car, with probably five tons more in weight of passengers, a distance of a mile and an eighth. This was up a grade of 70 feet to a mile, with one sharp curve, and was effected in eleven minutes. On the return the motor was thrown from the track, and several who were on it had narrow escapes, but the accident was due to a make-shift rope coupling, and did not involve Mr. Daft's principle at all. The dynamos at the factory for generating the current were 500 feet from the track, and were operated by a 30 horse power engine. The motor itself seemed entirely too small and light for the work expected from it, the dynamos thereof and connections occupying a box only about four by six feet. The current for these is taken up from the central track by a contact wheel, which transmits it to a receiving dynamo, and thence by connection with a steel belt through the axles to the outside rails causes the revolutions. The apparatus is easily operated, and evidently was entirely under control. Mr. Daft was warmly congratulated on the degree of success obtained, and the most of the numerous party present were confident that the trial was a proof of the practical success of the system.

A Stone Bridge over the Mississippi.

The first stone bridge across the Mississippi River has just been completed at a point a little below the Falls of St. Anthony. It is a massive stone structure, stretching to the east across the river, curving at first slightly to the left in a graceful sweep, and then running at right angles to the stream directly to the east side landing, the whole course being 2,100 feet. The upper surface of the bridge presents to the view a smooth stone roadway, carrying two tracks on four lines of steel rails and walled in on either side by heavy blocks of stone, high enough and strong enough to prevent a train from leaving the bridge, even should it be thrown from the rail. The viaduct crosses the river with twenty-three arches and sixteen spans of 80 feet each. The material is granite and magnesian limestone. The width is 28 feet over all, and the height from the springing point of the arches to the top is 50 feet 6 inches. One caisson required six months' work before stone laying could begin. Two hundred men have been employed on the bridge, and three lives have been lost in its construction. The cost was $990,000. The bridge was built for passenger traffic, and is to be used by the Manitoba, the Northern Pacific, the Omaha, and the St. Louis lines, and possibly by the Milwaukee. The possibility of running at full speed over it will result in reducing the time between Minneapolis and St. Paul from thirty to twenty minutes.

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